SPACE ENVIRONMENTAL EFFECTS ON OPTICAL FIBER CABLES

Ron Hartmayer, Shannon Jackson, and Alan R. Johnston

Jet Propulsion Laboratory
California institute of Technology
Pasadena, CA, 91109

Ten fiber optic cable samples of different types were exposed in low earth orbit for over 5 1/2 years on the Long-Duration Exposure Facility (LDEF). Four of the samples were mounted externally, and the remaining six were internal, under approximately 1/2 g cm^{-2} of aluminum, The experiment was recovered in January of 1990, and the effects of the exposure were evaluated in the laboratory after recovery. An increase in fiber loss, aging effects on polymer materials used in cabling, unique contamination effects on connector terminations, and micrometeoroid impacts were observed on some of the flight samples. All samples were functional, and the best exhibited no measurable change in performance.

In addition, radiation darkening of laboratory control samples and subsequent annealing was measured in the laboratory. The measured residual loss was related to the observed darkening of LDEF flight samples and found to be in agreement. The results of laboratory temperature tests on the flight samples, extending over a period of about nine years including the preflight and post -- flight analysis periods are described. The temperature response of the different cable samples vary widely, and appears in two samples to be affected by polymer aging.

Results from similar laboratory testing for the radiation and temperature response of present day fiber cable samples will be described. These new results will be compared with the LDEF data. Conclusions will be summarized.